AIR QUALITY
in the vicinity of the
FLY-ASH DISPOSAL AREA
at Ontario Hydro's
THUNDER BAY GENERATING STATION
1982

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INTRODUCTION

In 1980, vegetation sampling and a moss exposure experiment were carried out near the fly-ash disposal site at Ontario Hydro's Thunder Bay generating station. This survey showed that arsenic, calcium, chromium and iron were slightly elevated in moss exposed at sites nearest the disposal area. Contaminant levels were normal in vegetation foliage (1). At the time of the 1980 study, fly-ash and bottom ash from the station's 100-megawatt unit which burned bituminous coal were transported to the disposal area. In 1981 and 1982, two new lignite-fired units, each 150 megawatts, commenced operation at the power plant. Ash from these units was added to the same disposal area. Since lignite and bituminous ash differ physically and chemically, a second moss exposure experiment was conducted in 1982 to determine if any of the ash became windborne around the disposal site.

METHODS

Samples of Sphagnum moss were set out between May 12 and June 15 at 15 sites near the ash disposal site on Mission Island (Figure 1) and at 2 control locations remote from the study area. Following the exposure period, the samples were collected and submitted to the Ministry's Thunder Bay and Toronto laboratories for analysis of several trace elements known to occur in both types of fly-ash (2). Standard Ministry sampling, sample processing, and analytical procedures were followed (3, 4).

RESULTS

Levels of 23 trace elements in moss are tabulated in Table 1. There was no evidence of significantly elevated concentrations of any of the elements analysed. Aluminum, arsenic, barium, calcium, iron, sodium, strontium, titanium and vanadium were slightly

above background concentrations at some sites nearest the disposal area. Their concentrations decreased as distance from the most northern section of the disposal area (sampling sites 1 and 4) increased. The deposition pattern for arsenic (Figure 2) was typical for elements which showed concentration gradients.

Results from the 1980 and 1982 surveys are compared in Table 2. Concentrations of most elements were somewhat lower in 1982 than in 1980. However, copper and nickel levels were about an order of magnitude higher in 1982. This difference, which applied to all sites including controls, is attributed to contamination of the moss from an unknown source before the moss was used in the study.

CONCLUSION

Our 1982 study near the Ontario Hydro fly-ash disposal site on Mission Island revealed slight airborne enrichment of aluminum, arsenic, barium, calcium, iron, sodium, strontium, titanium and vanadium on the north side of the disposal area. No major changes in elemental contamination have been detected since the two new lignite fired units came into operation in 1981 and 1982.

Based on our findings, there is no indication of a significant environmental hazard. No further air quality studies in the area are warranted at present.

REFERENCES

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3. Ontario Ministry of the Environment. 1983. Field investigation procedures manual. Phytotoxicology Section, Air Resources Branch.

4. Ontario Ministry of the Environment. 1981. Outlines of analytical methods. Laboratory Services Branch.

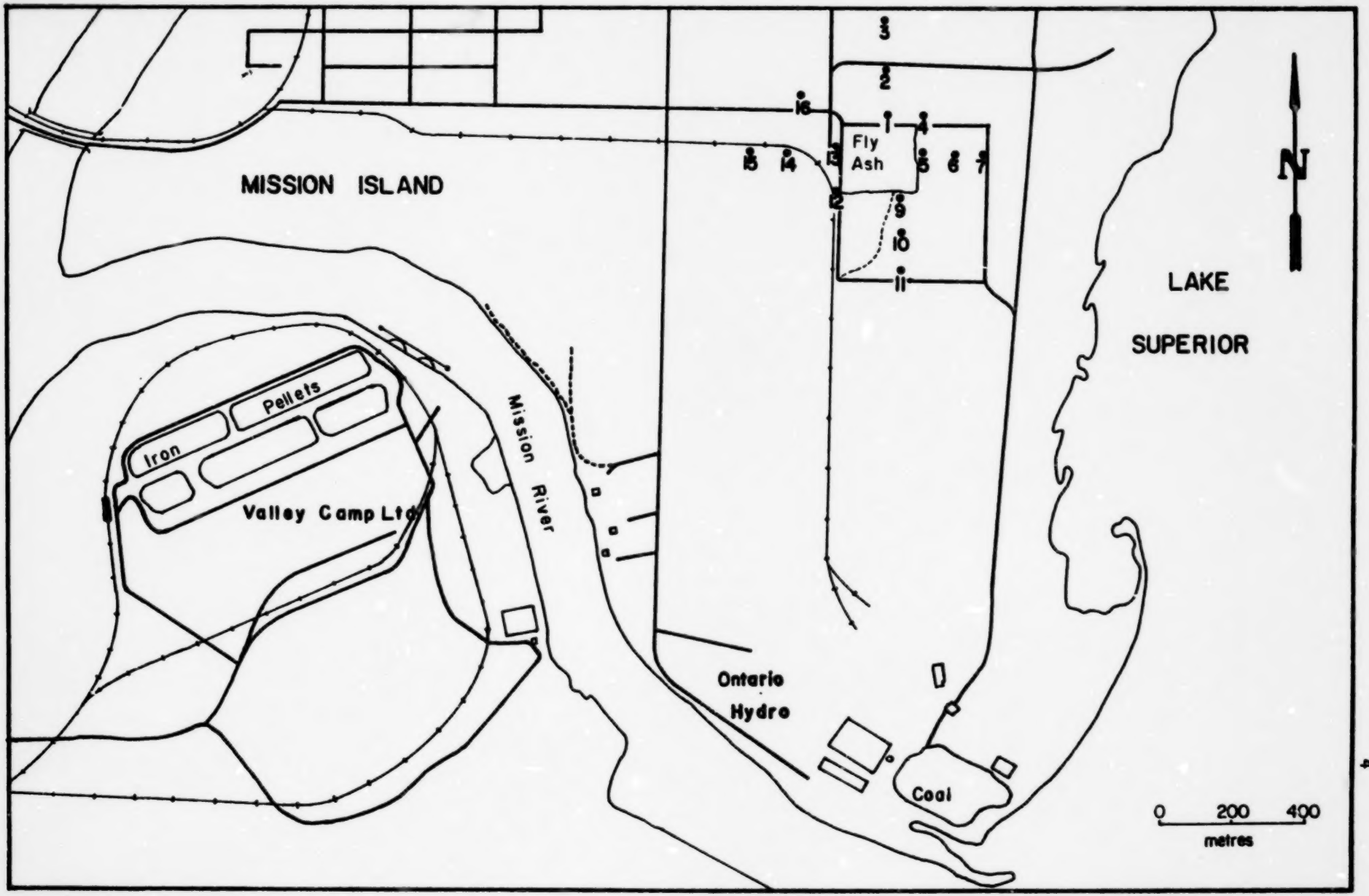

Figure I. Moss bag exposure sites, Thunder Bay, 1982.

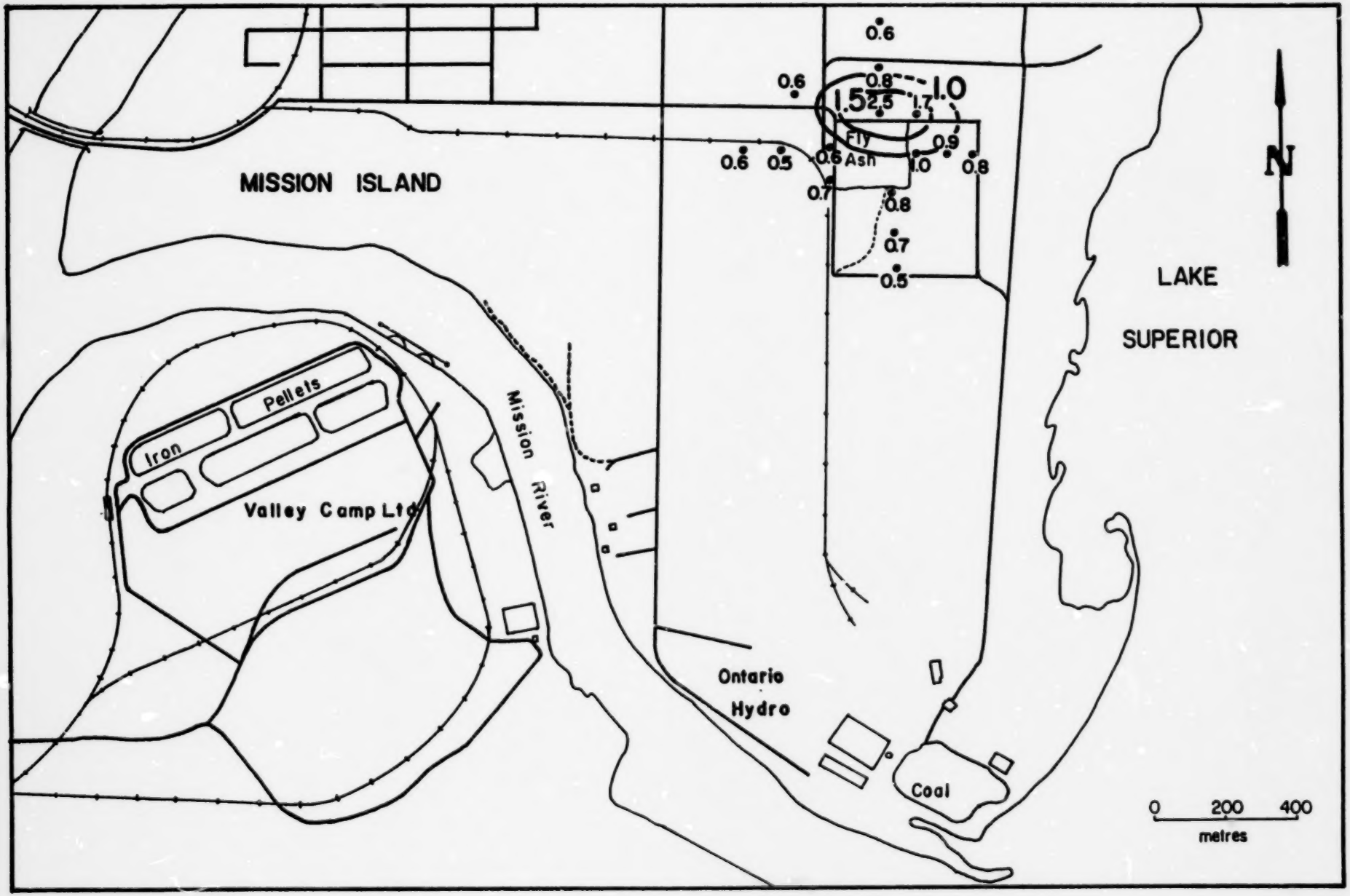

Figure 2. Levels of arsenic (µg/g, dry weight) in moss, Thunder Bay, 1982.

TABLE 1. Trace element concentrations (μg/g, dry weight) in moss exposed from May 12 to June 15, 1982.

Site	Al	As	Ba	Ca	Cd	Cl(%)	Cr	Cu	F	Fe	Hg	K	Mg	Mn	Na	Ni	Pb	S(%)	Se	Sr	Ti	V	Zn
1	2400	2.5	230	7400	<0.5	-	9.0	30	2	3000	0.1	1900	2100	350	2200	39	18	-	0.80	120	160	7	34
2	830	0.8	60	5300	<0.5	-	3.0	27	1	1700	0.1	2400	1500	280	370	41	23	-	<0.03	26	70	4	35
3	730	0.6	60	4400	<0.5	-	6.0	24	1	1300	0.1	2400	1400	360	360	36	20	-	<0.03	22	62	3	31
4	2000	1.7	61	6800	<0.5	-	2.0	30	1	2200	0.1	1800	1700	340	2000	37	24	-	<0.03	75	96	6	29
5	1100	1.0	110	6400	0.5	-	5.5	31	1	1600	0.1	3200	1700	380	540	45	28	-	<0.03	47	58	4	41
6	1100	0.9	-	6200	<0.5	-	2.0	30	1	1500	0.1	1900	1600	330	510	34	22	-	<0.03	-	-	-	38
7	910	0.8	81	6000	<0.5	0.01	6.5	26	1	1300	0.1	2300	1400	380	340	30	24	0.08	<0.03	28	78	4	40
9	900	0.8	90	5500	<0.5	0.02	5.0	24	1	1400	0.1	1200	1400	290	200	33	17	0.06	<0.03	34	72	4	28
10	710	0.7	22	5000	0.6	0.02	4.0	26	1	1300	0.1	1900	1400	310	220	38	20	0.06	<0.03	17	59	3	32
11	860	0.5	54	5700	0.6	0.01	7.0	42	1	1600	0.1	1600	1400	390	170	46	22	0.07	<0.03	19	59	3	38
12	1100	0.7	61	6500	0.6	0.02	7.0	33	1	1800	0.1	1300	1700	360	210	47	25	<0.07	<0.03	25	56	4	40
13	1000	0.6	84	5300	0.5	0.01	8.0	31	1	1400	0.1	1200	1300	280	330	38	25	0.06	<0.03	31	67	4	33
14	450	0.5	42	5700	<0.5	<0.01	4.0	25	1	1100	0.1	1500	1500	330	170	36	23	0.07	<0.03	15	57	3	34
15	760	0.6	36	5800	0.5	0.02	6.0	36	1	1300	0.1	1700	1500	360	160	46	26	0.08	<0.03	13	61	3	41
16	950	0.6	55	5600	1.3	0.02	4.5	30	1	1800	0.1	1600	1600	300	150	47	23	0.06	<0.03	23	65	4	33
Exposed control	560	0.4	40	4900	1.0	0.03	6.8	28	1	1000	0.1	2400	1300	260	70	42	22	0.08	<0.03	14	47	2	36
Unexposed control	760	0.3	40	5300	1.2	0.02	6.5	34	<1	1150	0.1	2600	1400	350	120	44	27	0.06	<0.03	12	48	2	43

TABLE 2. Comparison of selected trace element concentrations in moss exposed in 1980 and 1982 near Ontario Hydro's ash disposal area. All values are in µg/g, dry weight, except those for sulphur and chloride, which are in percent.

Element	Mean (± one standard deviation)[a]	
	1980	1982
Aluminum	1500 ± 330	1100 ± 550
Arsenic	2.5 ± 1.2	0.9 ± 0.5
Barium	-	75 ± 50
Cadmium	-	0.6 ± 0.2
Calcium	5900 ± 940	5800 ± 750
Chloride	-	0.015 ± 0.005
Chromium	9.0 ± 4.2	5.3 ± 2.1
Cobalt	1.1 ± 1.2	-
Copper	5 ± 1	30 ± 5
Fluoride	-	1 ± 0.2
Iron	3300 ± 1400	1600 ± 470
Lead	-	23 ± 3
Magnesium	2300 ± 280	1500 ± 200
Manganese	160 ± 61	330 ± 39
Mercury	0.4 ± 0.3	0.1 ± 0
Nickel	2 ± 1	39 ± 5
Potassium	-	1900 ± 540
Selenium	<0.3 ± 0	0.08 ± 0.2
Sodium	-	530 ± 650
Strontium	-	35 ± 29
Sulphur	0.07 ± 0.01	0.07 ± 0.01
Titanium	-	73 ± 27
Vanadium	-	4 ± 1
Zinc	54 ± 19	35 ± 4

[a]For all sites combined, excluding controls.